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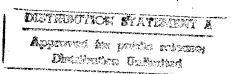
# Underground Water Distribution System Fort Belvoir, Virginia

Leak Detection Survey

19971023 148

CONTRACT #DACA01-94-D-0034 SYSTEMS CORP PROJECT #94013.09

August 1, 1995



#### DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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Heath Consultants Incorporated

July 24, 1995

Headquarters — Mideast Region R.D. #3, Box 325 Belle Vernon, PA 15012 412-929-2300 1-800-HEATH US (432-8487) FAX 412-929-4872

Mr. Charles Belt Systemscorp Cherokee Place, Suite 306 2200 Sutherland Avenue Knoxville, Tenn. 37919

Dear Mr. Belt;

This is the final report of your recently completed Heath Consultants Leakage Detection Survey. The survey was conducted by myself, Donald Muir, Operations Coordinator, and required 12.25 working days. This was not a survey of the entire water distribution system but instead a survey of water mains 8 inch and larger. A total of 31 leaks were detected with an estimated loss of 243 gallons per minute. This would result in a loss of 349,920 gallons per day and a loss of 127,720,800 gallons per year.

The Heath Aqua-Scope was used to perform the survey. The Aqua-Scope is an electro-sonic amplification device capable of detecting leakage as small as 10 gallons per hour. The Aqua-Scope consists of a headset worn by the operator, a direct contact microphone, a ground microphone, and a control console with a volume control and an on/off switch. In addition, a computerized leak correlator was used to pinpoint the location of several leaks.

As with most water systems, the majority of leaks detected were small leaks. 20 of the 31 leaks were either leaking fire hydrants or leaking main valves. Only 1 service line was found leaking. This was a yard hydrant outside of an airplane hanger at the airfield. The small number of service line leaks can be contributed to the fact that the majority of buildings are supplied by mains that are less than 8 inch in diameter and therefore were not part of the leakage detection survey. The remaining 10 leaks were leaks found on the mains themselves. These 10 leaks were responsible for 76% of the total water loss.

It is impossible to stop water system leakage entirely. Proper preventative maintenance of the distribution system and an ongoing leakage detection and repair program can keep leakage to a minimum. Very few water leaks actually appear above ground. The majority of

Mr. Charles Belt July 24, 1995 Page 2

leaks find their way into the surrounding rock structure or into nearby utility line ditches and never appear above ground.

Knowing this, some type of leakage detection program is needed. The program can be contracted to an outside firm or performed in-house. Detection equipment can be as sophisticated as an Aqua-Scope and leak correlator or as simple as placing your ear onto a valve key and listening for leakage noise. Leakage detection can be incorporated into routine system maintenance. Listening for the presence of leakage noise on fire hydrants during flushing and listening on valve keys while exercising valves will tell if any leaks are nearby. The key to leakage detection is the number of contact points available onto the water line. Therefore it is necessary that all main line valve and service line valves be located and brought to ground level if buried. What must be remembered though is that any type of leakage detection progam is better than no leakage detection program.

Several recommendations can be made to improve the water system at Fort Belvoir. They are as follows:

- 1. Not all large leaks are on large diameter water mains. A comprehensive survey of the remainder of water system should be undertaken.
- 2. An ongoing leakage detection program must be initiated. This program can be performed in-house or by an outside firm.
- 3. A large number of the leaks detected were fire hydrant leaks. These hydrants are very old and ideally need replaced. In lieu of this, repairing the leaking hydrants and verifying that hydrants are completely shut off after flushing will reduce water loss.
- 4. A water system can not have too many valves. All main line valves and service line valves should be located and if buried, valve boxes should be brought up to ground level.
- 5. During the survey it was found that water mains are exposed at several creek crossings. These lines need to be buried and/or reinforced to prevent damage due to freezing or damage due to foreign objects striking mains.
- 6. A large amount of the water main on the post runs through wooded areas. Leakage in these areas can occur for long periods of time before being discovered. These lines need to be located, their location marked, and inspected regularly to insure leakage is not present

Mr. Charles Belt July 24, 1995 Page 3

7. Individual buildings on base do not have water meters. Leakage inside the buildings needs to be identified and repaired. Leakage inside the buildings is actually more expensive than underground leakage due to the fact that sewage flow is metered.

Heath Consultants was requested by Fort Belvoir personnel to note during the survey any areas that needed maintenance. The following is a list of such areas.

- 1. Washington Village The majority of service line curb boxes are filled with stone and need cleaned out
- 2. Water main is exposed in creek crossing at intersection of Soldier Road and Statesman Road
- 3. Both 12 inch mains are exposed at the creek crossing north of Building #1494.
- 4. 12 inch main exposed in woods behind Building #1422.
- 5. 12 inch main exposed at blow-off at creek crossing in woods behind Youth Services Center .
- 6. Head for air release valve on 16 inch main at Cheney School not installed.
- 7. 10 inch main valve box knocked over in woods behind Building #1000.
- 8. 10 inch main valve boxes northeast of Building #1000 washed out and missing
- 9. Main valve box near Building # 2604 paved over.
- 10. Air release valve at intersection of Abbott Road and Forster Road buried.
- 11. Main valve boxes at intersection of Gorgas Road and Woodlawn Road buried
- 12. Blow-off valve along Route 1 at Accotink Creek buried.
- 13. Could not locate 10 inch main valve boxes on north side of Route 1 at Gunston Road
- 14. Could not locate main valve boxes on west side of Belvoir Road at Farrell Road near DeWitt Hospital

Mr. Charles Belt July 24, 1995 Page 4

Concern was raised as to whether our leakage detection survey was performed in accordance to the AWWA Standard M-36 "Water Audits and Leak Detection." All Heath Consultants surveys are conducted in accordance to the AWWA Standard M-36. In fact, Mr. Tim Brown of Heath Consultants sits on the Advisory Board overseeing Standard M-36.

Very little survey at Fort Belvoir was performed at night. The water mains running along Route 1 were an exception. Several nights were required to survey along Route 1 since survey could only be performed between the hours of 3:00 a.m. and 5:00 a.m. when traffic was its lightest. The majority of water main at Fort Belvoir does not run under paved road. Most of the line runs in the soil off the road on the road shoulder. Once the morning rush of base employees was over, the base was actually a very quiet place to survey.

Noise created by water consumption was not a problem. A large number of the buildings on base are supplied from water mains that are less than 8 inch in diameter and, therefore, was not part of the survey. Buildings supplied by mains that were surveyed in general do use great amounts of water. Buildings such as classrooms and office buildings in general need water only for restrooms and drinking fountains. In addition, noise created by a water line will be constant. This noise will not stop while noise created by consumption will stop and start indicating to the survey consultant that this noise is not a leak.

It has been a pleasure working with Systemscorp at Fort Belvoir. If you have any questions on this survey or if we can be of any further service, please do not hesitate to contact our Regional Office at 412-929-2300.

Sincerely,

Don Muir Jr.

Area Operations Coordinator

Don Muir Jr., ml.

DM/mh cc: File



# Summary of WATER LEAKAGE CONTROL SURVEY

**FOR** 

SYSTEMSCORP/FORT BELVOIR	FORT BELVOIR, VA	
COMPANY	CITY AND STATE	DISTRICT OR DIVISION
Conducted by Our Consultant(s)	Donald Muir Jr.	
DATE STARTED6-21-95	DATE COMPLETED 7-17-95	

			ESTIMATED LEAKAGE		AGE
	CLASSIFICATION	NUMBER	GPM	GPD	GPY AF/Y
1	15 to +15 gpm	4	160 gpm	230,400 gpd	84,096,000 gpy
2	5 to 14 gpm	. 4	35 gpm	50,400 gpd	18,396,000 gpy
3	1 to 4 gpm	23	48 gpm	69,120 gpd	25,228,800 gpy
	TOTALS	31	243 gpm	349,920 gpd	127,720,800 gpy

GPM = Gallons/Minute

GPD = Gallons/Day

GPY = Gallons/Year

AF/Y = Acre Feet/Year

SOURCE OF LEAKAGE	NUMBER	GPM	% OF TOTAL NO.	% OF TOTAL EST. GPM
MAINS	10	185 gpm	32.3%	76.1%
SERVICES	1	1 gpm	3.2%	0.4%
VALVES	6	14 gpm	19.4%	5.8%
HYDRANTS	14	43 gpm	45.1%	17.7%
TOTALS	31	243 gpm	100.0%	100.0%

TYPE OF SURVEY PERFORMED Comprehensive Water-8" & larger MILES OF MAIN INSPECTED 32.0 mi.

NUMBER OF SERVICES INSPECTED N/A (If applicable)

NUMBER OF LEAK INDICATIONS 31

#### LEAK INDICATION CLASSIFICATION

Leak indication classification is not an exact science. In spite of the use of the most modern instruments plus complete training and experience by the consultant, it is impossible to determine the exact condition of underground piping without actually exposing same. In view of this limitation, our classification (including estimated volume loss) is intended as an aid in scheduling repairs based upon the information available, the consultant's judgement, and site conditions at the time the report is prepared. Variable factors beyond our control may alter this classification at any time. Once the leak is exposed for repair, the utility may wish to revise the volume loss estimate, in order to establish a more accurate estimate of actual water loss.

Grade 1 (C)	15	to +1!	5 GPM
Grade 2 (B) _		to1	4 GРМ
Grade 3 (A)	1	to	4GPM

#### SPECIAL CASES

Contact Heath Consultants Incorporated for further information regarding any Special Case such as: emergency assistance, inspecting river/canal crossings, analysis/audit of in-house leakage programs, third party verification, hands-on training, etc.

Our consultants will be available on a 24-hour notice to assist you.

# POSITIVE STREET REPORTS

INDEX

#### POSITIVE STREET REPORTS

LOCATION	PAGE NO.	LEAK CLASSIFICATION
Abbot Road @ #2115	26	3
Arnold Rd. south of 9th St.	12	2
Belvoir Rd. behind #1000	10	3
12" main valve at Building #1003	14	3
Building T-1426 @ Fire Hydrant	2	3
Davidson Airfield @ #1351	31	3
Davison Airfield @ Building #1357	30	3
Goethals Rd. @ Beauregard Rd.	23	3
Gunston Rd. @ #S-1147	9	2
Guston Rd. @ #1195 - Fire Hydrant	8	3
Gunston Rd. @ Fifth St.	5	3
Hall Rd. @ Bldg. #1464 - Fire Hydrant	: 4	3
Hurley Road ! #805	15	3
Iry Road @ #1970	24	3
Iry Rd. @ #1972	25	3
Jackson Loop at Building #1434-Valve	3	3
Jackson Loop @ 1440 - Fire Hydrant	1	3
Lyman Loop @ Fire Hydrant	18	1
Meeres Road @ #1741	13	3
Rossell Loop @ 21st St.	21	3
Spengler Loop @ 21st St.	19	2
Theote Rd. near S-628	28	1
Totten Rd. @ #338	29	3
Third St. east of Gunston Rd.	6	3
Third St. west of Chapek St.	7	3
12th St. @ #1017 (Barden School)	11	3
16th St. @ #740	16	1
16th St. @ Building #193	27	2
16th St. west of Dalrymple St.	17	3
18th St. @ Rear of #130	22	3
21st Street @ Rear of #165	20	1



Page No	/	
Date	6-21-95	
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Ownership	Public Private Easement	
Leak Indicati	on Classification	
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9030 Monroe Road, Houston, TX 77061

**LEAKAGE CONTROL REPORT** WATER SURVEY

	J		
Company System corp Dity Accor	FUNT BELVOIR	District	
city ACCOT	INK	State	
	•	Street Address	
JACKSON LOQ	P. AT. 1440- P	The hydrant	
NDICATION OF LEAK	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON:	COVER
Sonic	Main Valve	Main	Concrete
Surfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
STIMATION OF LEAKAGE:	Hydrant	Valve	Soil
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Page No. \_ Date \_ Public Private Ownership Easement Leak Indication Classification II(B) (Circle One) (A)III I(C)

9030 Monroe Road, Houston, TX 77061

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Other	Meter Box		Joint Connection		Brick
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LEAKAGE	CON	ITROL	REPORT
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Surfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
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9030 Monroe Road, Houston, TX 77061

Company Representative

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9030 Monroe Road, Houston, TX 77061

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Sonic 🗸	Main Valve	Main	Concrete
Surfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
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Surfaced Water	Curb Valve		Service Asphalt	
Other	Meter Box		Joint Connection Brick	
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## LEAKAGE CONTROL REPORT WATER SURVEY

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Company Systemco	10 FONT Belvoir	State	
City	Nearest S	Statetreet Address	
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Surfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
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Compa	ny Representative	Heath C	onsultant





Page No		
Date	6-26-75	
Ownership	Public Private Easement	
Leak Indicati	ion Classification _ 1	

	SURVEY	
Company Systems corp  City According According to the Acc	/Fr Belvoin	District
City Acc	TINE	State
_	Nearest	st Street Address
Gunston, Rd	M # 5-11	
INDICATION OF LEAK	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON: COVER
Sonic X	Main Valve	Main Concrete
Surfaced Water	Curb Valve	Service Asphalt
Other	Meter Box	Joint Connection Brick
	Selected Test	Hydrant Gravel
ESTIMATION OF LEAKAGE:	Hydrant	Valve Soil
10 9pm		Misc. Other
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Company	Representative	Heath Consultant



Page No	10	
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Ownership	Public (Private) Easement	
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	P/FT Belvanc	StateStreet Address	
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DICATION OF LEAK	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON:	COVER
onic X	Main Valve	Main 🔀	Concrete
urfaced Water	Curb Valve	Service	Asphalt
ther	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
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Ownership	Public (Private ) Easement	
Leak Indicat	ion Classification	
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		Street Address	
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NDICATION OF LEAK	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON:	COVER
Sonic	Main Valve	Main	Concrete
Surfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
STIMATION OF LEAKAGE:	Hydrant	Valve	Soil
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Ownership	Public	Private	Fasement	
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	,	(Circle One)	3	

# LEAKAGE CONTROL REPORT WATER SURVEY

	_	State/Aest Street Address	
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faced Water	Curb Valve	Service	Asphalt
er	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
MATION OF LEAKAGE:	Hydrant	Valve	Soil
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Ownership	Public Private Easement	
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urfaced Water	Curb Valve	Service	1	Asphalt	
ther	Meter Box	Joint Connection		Brick	
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TIMATION OF LEAKAGE:	Hydrant	Valve		Soil	$\perp \downarrow$
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	(Circle One)	

# LEAKAGE CONTROL REPORT WATER SURVEY

NDICATION OF LEAK		LEAKAGE DETECTED AT:  Main Valve	TO BE ON:	COVER
Sonic Surfaced Water		Curb Valve	Service	Asphalt
Other		Meter Box	Joint Connection	Brick
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STIMATION OF LEAKA	GE:	Hydrant	Valve	Soil
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Page No. Private Ownership Public Easement Leak Indication Classification 2

(Circle One)

9030 Monroe Road, Houston, TX 77061

<b>LEAKAGE</b>	CON	NTROL	REPORT
WA	TER	SURVE	ΞY

		ilest Street Address	
HURLEY K	Repol AT # 80	5	
NDICATION OF LEAK	LEAKAGE DETECTED AT	LEAK APPEARS TO BE ON:	COVER
Sonic	Main Valve	Main .	Concrete
Surfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
STIMATION OF LEAKAGE:	Hydrant	;∕ Valve	Soil
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Page No		14		
Date	B	6-28	-55	
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onic	Main Valve .		Main Kyd	LAT. X	Concrete	
urfaced Water	Curb Valve		Service		Asphalt	
ther	Meter Box		Joint Connec	tion	Brick	
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TIMATION OF LEAKAGE:	Hydrant	Z	Valve		Soil	
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	(Circle One)	

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Company Jystem Con	P/F Belvoin	District
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		t Street Address
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NDICATION OF LEAK	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON: COVER
Sonic . /	Main Valve	Main Concrete
Surfaced Water	Curb Valve	Service Asphalt
Other Other	Meter Box	Joint Connection Brick
<u> </u>	Selected Test	Hydrant 🔀 Gravel
STIMATION OF LEAKAGE:	Hydrant >	Value
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Compa	iny Representative	Heath Consultant



Page No	18	<u></u>
Date	6-29-95	
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Leak Indicat	ion Classification  2 3	

# LEAKAGE CONTROL REPORT WATER SURVEY

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Page No		19
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ompany Systemcusp ty Accuti	Nagreet C	State treet Address	
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SPENGLER	Loop AT d	57	
DICATION OF LEAK	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON:	COVER
onic X	Main Valve	Main	Concrete
urfaced Water	Curb Valve	Service	Asphalt
ther	Meter Box	Joint Connection	Brick .
	Selected Test	Hydrant	Gravel
TIMATION OF LEAKAGE:	Hydrant	Valve	Soil
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Page No	4	20
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Ownership	Public	Private Easement
Leak Indicat	ion Class	sification
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		(Circle One)

Nearest St		
Λ	reet Address	
st Resn of	# 165	
LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON:	COVER
Main Valve	Main	Concrete
Curb Valve	Service	Asphalt
Meter Box	Joint Connection	Brick
Selected Test	Hydrant	Gravel
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Page No	21	
Date	7-11-95	
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Ownership	Public Private Easement	
Leak Indicat	ion Classification	
	Circle One)	

# LEAKAGE CONTROL REPORT WATER SURVEY

	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON:	COVER
DICATION OF LEAK	Main Valve	Main	Concrete
onic urfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
Attici	Selected Test	Hydrant	Gravel
TIMATION OF LEAKAGE:	Hydrant	Valve	Soil
2 4/1		Misc.	Other
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emarks	21st st	Posser Fond	31.51.51
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Rossell La	rop & al ter.	Street /CTKI.	5. UM-121- 34-19C



Page No	22	
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Leak Indicat	on Classification	
	(Circle One)	

			LEAK APPEARS				
IDICATION OF LEAK	LEAKAGE DETECTED AT	; ;	TO BE ON:		COVER		<del></del>
Sonic	Main Valve	X	Main	$\dashv$	Concrete	<u>e</u>	
Surfaced Water	Curb Valve	+	Service Joint Connection	++	Brick		
Other	Meter Box Selected Test	+-1	Hydrant	+	Gravel		
STIMATION OF LEAKAGE:	Hydrant	+-		+	Soil		-
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23 Page No. \_\_\_ 7-13.55 Date \_\_\_ Ownership Public (Private) Easement Leak Indication Classification 2

(Circle One)

9030 Monroe Road, Houston, TX 77061

#### LEAKAGE CONTROL REPORT WATER SURVEY

SDETHALS, R	Beaute	LEAK APPEARS	
CATION OF LEAK	LEAKAGE DETECTED AT:	TO BE ON:	COVER
nic X	Main Valve	Main	Concrete
faced Water	Curb Valve	Service	Asphalt Brick
ner	Meter Box	Joint Connection	Gravel
MATION OF LEAKAGE:	Selected Test	Hydrant	Soil
	Hydrant	Valve	Other
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Page No		24		
Date		7-13-	95	
Ownership	Public	(rivate)	Easement	
Leak Indicat	ion Class	ification		

Company Representative

company Systemcoul	SURVEY				
company Stemconf	/ For Belvoin	<u></u>	District		
ity Accor	INIC	<del></del> '	State		
		rest Stre	et Address		
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NDICATION OF LEAK	LEAKAGE DETECTED AT	:	LEAK APPEARS TO BE ON:		COVER
Sonic	Main Valve	X	Main .		Concrete
Surfaced Water	Curb Valve		Service		Asphalt
Other	Meter Box		Joint Connection		Brick
	Selected Test		Hydrant	X	Gravel
STIMATION OF LEAKAGE:	Hydrant	X	Valve	_1_]	Soil
39pm			Misc.		Other
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LEAKING A	ydrs NT AT	10.	1971 1972		
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Page No	25	
Date	7-13-85	
Ownership	Public Private Easement	
Leak Indicat	ion Classification	

(Circle One)

<b>LEAKAGE</b>	CONTROL	REPORT
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mpany JSTEMOND ACCI	FT Belvoin	District	
y		treet Address	
Pay 01	# 1077		
TRY Rd AT	# 1972		
		LEAK APPEARS	
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onic X	Main Valve .	Main	Concrete
urfaced Water	Curb Valve	Service	Àsphalt
Other	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant 🗸	Gravel
TIMATION OF LEAKAGE:	Hydrant /	Valve	Soil
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# LEAKAGE CONTROL REPORT WATER SURVEY

ABBOT ROD	d # 211		
ICATION OF LEAK	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON:	COVER
onic X.	Main Valve	Main	Concrete
urfaced Water	Curb Valve	Service	Asphalt
ther	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
TIMATION OF LEAKAGE:	Hydrant	Valve	Soil
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9030 Monroe Road, Houston, TX 77061

LEAKAGE	CON	ITROL	RE	POI	<b>?T</b>
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		rest Street Addres		
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NDICATION OF LEAK	LEAKAGE DETECTED AT		APPEARS ON:	COVER
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	Selected Test	Hydra		Gravel
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(Circle One)

<b>LEAKAGE</b>	CON	NTROL	<b>REPORT</b>
WA	TER	SURVE	ΞY

company Systemconf	/FT Belvoin	District	
city		State // A	
01	Nearest Stre	et Address	
Theore Rd	NEAR 5-628		
NDICATION OF LEAK	LEAKAGE DETECTED AT:	LEAK APPEARS TO BE ON:	COVER
Sonic	Main Valve	Main	Concrete
Surfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
ESTIMATION OF LEAKAGE:	Hydrant	Valve	Soil
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Surfaced Water	Curb Valve	Service	Asphalt
Other	Meter Box	Joint Connection	Brick
	Selected Test	Hydrant	Gravel
TIMATION OF LEAKAGE:	Hydrant	Valve	Soil
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# LEAKAGE CONTROL REPORT WATER SURVEY

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city Acco	TINE	State		
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Other	Meter Box	Joint Connection	Bri	ck
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HEATH CONSULTANTS INCO	III ONATE
9030 Monroe Road, Houston,	TX 77061

#### LEAKAGE CONTROL REPORT WATER SURVEY

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